

Atty. Docket No. PLA31071

Serial No: 10/750,489

Remarks

Applicant and his representatives wish to thank Examiner Lee for the thorough examination of the present application and the detailed explanations in the Office Action dated October 28, 2005.

The present invention relates to a method of fabricating an MIM capacitor of high capacitance in a semiconductor device. The method (as set forth in amended Claim 1, above) generally includes the steps of (a) depositing an interlayer dielectric film on a metal line, (b) etching the interlayer dielectric film to form an MIM capacitor forming region, (c) sequentially depositing a lower electrode layer comprising TiN, an insulator layer and an upper electrode layer on the interlayer dielectric film, (d) etching the lower electrode layer, the insulator layer and the upper electrode layer to form an MIM capacitor, wherein a capacitance of the MIM capacitor is determined by controlling a thickness of the interlayer dielectric film.

In another embodiment, the method (as set forth in amended Claim 7, above) generally includes the steps of (a) depositing an interlayer dielectric film on a metal line; (b) planarizing the interlayer dielectric film, (c) etching the interlayer dielectric film to form an MIM capacitor forming region, (d) sequentially depositing a lower electrode layer, an insulator layer and an upper electrode layer on the interlayer dielectric film, and (e) planarizing the lower electrode layer, the insulator layer and the upper electrode layer by an etch back process to form an MIM capacitor, wherein a capacitance of the MIM capacitor is determined by a thickness of the interlayer dielectric film.

The references cited against the claims (Rasmussen, U.S. Patent Application Publication No. 2004/0262658, and Lopatin, U.S. Patent No. 6,433,379) neither disclose nor suggest depositing a lower electrode layer comprising TiN (see amended Claim 1). Furthermore, the cited references neither disclose nor suggest planarizing the lower electrode layer, the insulator layer, and the upper electrode layer by an etch-back process (see amended Claim 7). Consequently, the present claims are patentable over the cited references.

Atty. Docket No. PIA31071
Serial No: 10/750,489

The Rejection of Claims 1, 3, 5-7, 9-10, and 12-13 under 35 U.S.C. § 102(e)

The rejection of Claims 1, 3, 5-7, 9-10 under 35 U.S.C. § 102(e) as being anticipated by Rasmussen is respectfully traversed.

Rasmussen discloses a method of forming an MIM capacitor, with a lower electrode made of osmium (Os), platinum (Pt), rhodium (Rh), ruthenium (Ru), palladium (Pd), or iridium (Ir) (see, e.g., Rasmussen, page 4, paragraph [0042]), but is silent with respect to a lower electrode made of TiN as recited in independent Claim 1. Furthermore, Rasmussen is silent with respect to planarizing the lower electrode layer, the insulator layer, and the upper electrode layer, as recited in independent Claim 7. Thus, Rasmussen fails to teach or suggest all of the limitations of independent Claims 1 and 7. Therefore, independent Claims 1 and 7 and dependent Claims 3, 5, 6, 9, 10, 12, and 13 are patentable over Rasmussen. Accordingly, this ground of rejection is unsustainable, and should be withdrawn.

The Rejection of Claims 4, 11, 14, and 15 under 35 U.S.C. § 103(a)

Claims 4, 14, and 15 have been cancelled. The rejection of Claim 11 under 35 U.S.C. § 103(a) as being unpatentable over Rasmussen in view of Lopatin is respectfully traversed. Independent Claim 1 has been amended to include the limitation of depositing a lower electrode layer comprising TiN, as partially recited in the original Claim 4. Therefore, the rejection of Claim 4 under 35 U.S.C. § 103(a) as being unpatentable over Rasmussen in view of Lopatin is respectfully traversed, insofar as the rejection may now apply to the amended Claim 1. Independent Claim 7 has been amended to include the limitation of planarizing the lower electrode layer, the insulator layer, and the upper electrode layer by an etch-back process, as recited in the original Claim 15. Accordingly, the rejection of Claim 15 under 35 U.S.C. § 103(a) as being unpatentable over Rasmussen in view of Lopatin is respectfully traversed, insofar as the rejection applies to the amended Claim 7.

As discussed above, Rasmussen is deficient with respect to a lower electrode made of TiN as recited in independent Claim 1. Furthermore, Rasmussen is deficient with respect to

Atty. Docket No. PIA31071
Serial No: 10/750,489

planarizing the lower electrode layer, the insulator layer, and the upper electrode layer, as recited in independent Claim 7.

Lopatin fails to cure the deficiencies of Rasmussen with respect to the present Claims. Lopatin discloses a method of fabricating an MIM capacitor, with a lower electrode comprising titanium, zirconium, aluminum, niobium, tungsten, chromium or copper (see, e.g., Lopatin, col. 4, lines 62-64), but is silent with respect to a lower electrode made of TiN. Thus, the combination of Rasmussen and Lopatin does not disclose or suggest all of the limitations of independent Claim 1. Lopatin further discloses that the lower electrode layer, the insulator layer and the upper electrode layer may be planarized by a CMP process (see, e.g., col. 7, lines 2-7), but is silent with respect to an etch-back process. Thus, the combination of Rasmussen and Lopatin does not disclose or suggest all of the limitations of independent Claim 7.

Therefore, independent Claims 1 and 7 are patentable over Rasmussen in view of Lopatin. Accordingly, the rejection of Claims 4 (to the extent that Claim 4 has been integrated with Claim 1), 11, and 15 (to the extent that Claim 15 has been integrated with independent Claim 7) under 35 U.S.C. § 103(a) as being unpatentable over Rasmussen in view of Lopatin is unsustainable, and should be withdrawn.

Conclusions

In view of the above amendments and remarks, all bases for objection and rejection are overcome, and the application is in condition for allowance. Early notice to that effect is earnestly requested.

Atty. Docket No. PIA31071
Serial No: 10/750,489

If it is deemed helpful or beneficial to the efficient prosecution of the present application,
the Examiner is invited to contact Applicant's undersigned representative by telephone.

Respectfully submitted,



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